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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/074,884

02/13/2002

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EXAMINER

ERDEM, FAZLI

ART UNIT

PAPER NUMBER

2826

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
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3 MONTHS

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

**Office Action Summary**

Application No.

10/074,884

Applicant(s)

RAMKUMAR, KRISHNASWAMY

Examiner

Fazli Erdem

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 14 November 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 6-12, 15, 17-21, 23, 24, 26, 27 and 30-35 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 6-12, 15, 17-21, 23, 24, 26, 27 and 30-35 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Response to Arguments***

1. Applicant's arguments with respect to claim 6 have been considered but are moot in view of the new ground(s) of rejection.

### ***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 6-11, 19-21, 23 and 24 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The term "substantially similar gate to substrate capacitance" in claim 6, the term "greater density than said oxide gate dielectric" in claim 10, "fewer defects than said oxide gate dielectric" in claim 11 and "substantially similar temperature as said first temperature in claim 19 are relative terms, which render the claim indefinite. The terms "substantially similar gate to substrate capacitance", "greater density than said oxide gate dielectric", "fewer defects than said oxide gate dielectric" and "substantially similar temperature as said first temperature" are not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. Examiner cannot ascertain what "substantially similar gate to substrate capacitance" and "substantially similar temperature as said first temperature" mean. Furthermore, oxide layer specification is not defined in claim 6 and hence in the comparison and relative terminology that refers to the "said oxide layer" in claims 10 and 11 are indefinite.

***Claim Rejections - 35 USC § 102***

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 6-8 rejected under 35 U.S.C. 102(b) as being anticipated by Gardner et al. (6,066,519).

Regarding Claim 6, Gardner et al. disclose a semiconductor device having an outgassed oxide layer and fabrication thereof where in column 5, lines 14-33 and in Fig. 4, it is disclosed a semiconductor device comprising an oxide layer and a nitride layer gate dielectric having substantially similar gate to substrate capacitance as an oxide gate dielectric comprising thickness 5-10 Angstrom wherein the oxide-nitride gate dielectric comprises a silicon dioxide layer 403 (see claim 19) and a distinct silicon nitride layer 405.

Regarding Claim 7, capacitance of the 403/405 gate dielectric combination has an equivalent capacitance of oxide gate dielectric of 10-25 Angstroms as disclosed in column 5 lines 29-33.

Regarding Claim 8, the thickness of 405 is selected to be different thickness, i.e. 15-20 angstroms and the thickness of 403 can be 5-25 angstroms as disclosed in column 5, lines 13-58.

***Claim Rejections - 35 USC § 103***

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4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 12, 15, 17 and 31 rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner et al. (6,245, 652) in view of Foglietti et al. (2002/0142500).

Regarding Claim 12, Gardner et al. teach a method of making semiconductor device comprising growing an oxide film 14 in Fig. 2, upon a semiconductor topography 10, depositing a silicon nitride film 16, upon and in contact with the oxide film and annealing the semiconductor topography subsequent to the step of depositing the silicon nitride film (column 3, lines 40-41, column 4, lines 49-50). Gardner et al. fail to disclose the required ozonated substance comprising ozonated deionized water. However, Foglietti et al. teach in step an ozonated deionized water rinse is employed to remove contaminants and to form an interfacial oxide over the exposed portion of the base region (page 3, [0038] and page 4, [0041]).

It would have been obvious to one of having ordinary skill in the art at the time the invention was made to include the required ozonated deionized water rinse in Gardner et al. as taught by Foglietti et al. in order to have an interfacial oxide with good control which maintains its integrity during subsequent processing (page 4, paragraph [41]).

Regarding Claim 15, in paragraph 13 Foglietti discloses an ozone concentration of 1.6 ppm. Paragraph 40 discloses ozone concentration within the deionized water may be varied and in the range of about 1-15 parts per million. It would have been obvious to

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one of having ordinary skill in the art at the time the invention was made to have an ozone concentration of 20-50 ppm, because Fogliette teaches the ozone concentration is easily controlled and there are advantages to using a higher ozone concentration. (Pages 3-4, paragraphs 0040 and 0041).

Regarding Claim 17, annealing layers in nitrous oxide is disclosed in Gardner et al. column 3, lines 40-41 and annealing layers in ammonia is disclosed in Gardner et al. column 4, lines 49-50.

Regarding Claim 31, annealing layers in ammonia is disclosed in Gardner et al. column 4, lines 49-50.

6. Claim 18 rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner et al. (6,245, 652) in view of Foglietti et al. (2002/0142500) further in view of DeTar (6,077,791).

Regarding Claim 18, Gardner et al. teach a method of making semiconductor device comprising growing an oxide film 14 in Fig. 2, upon a semiconductor topography 10, depositing a silicon nitride film 16, upon and in contact with the oxide film and annealing the semiconductor topography subsequent to the step of depositing the silicon nitride film (column 3, lines 40-41, column 4, lines 49-50). Gardner et al. fail to disclose the required ozonated substance comprising ozonated deionized water. However, Foglietti et al. teach in step an ozonated deionized water rinse is employed to form an interfacial oxide over the exposed portion of the base region (column 3, [0038, first paragraph] and column 4, [0041, first paragraph]). Furthermore, Foglietti et al. disclose the ozonated dionized water in paragrapsh 38 and 41. Gardner et al. and Foglietti et al.

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fail to disclose the required deuterium ammonia annealing. However, DeTar discloses method of forming passivation layers using deuterium containing reaction gases where in column 3 lines 1-20, the required deuterium ammonia is disclosed.

It would have been obvious to one of having ordinary skill in the art at the time the invention was made to include the required deuterium ammonia in Gardner et al. in view of Foglietti et al., as taught by DeTar combination in order to have a gate dielectric/passivation layer with ease of manufacture, reduced hydrogen gas usage and long term reliability (column 4, lines 1-7)

6. Claims 26, 27, 30, 33 and 35 rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner et al. (6,245, 652) in view of DeTar (6,077,791).

Regarding Claim 26, Gardner et al. teach a method of making semiconductor device comprising growing an oxide film 14 in Fig. 2, upon a semiconductor topography 10, depositing a silicon nitride film 16, upon and in contact with the oxide film. Gardner et al. fail to disclose the required ozonated substance comprising deuterium oxide. However, DeTar discloses a method of forming passivation layer using deuterium containing reaction gases where in column 2, lines 61-63, column 3 lines 50-67 and in claim 1, the required ozonated deuterium oxide substance is disclosed.

It would have been obvious to one of having ordinary skill in the art at the time the invention was made to include the required ozonated dionized water rinse in Gardner et al. as taught by DeTar in order to have a oxide/dielectric/passivation layer with long term reliability (column 4, lines 1-7).

Regarding Claim 27, oxide layer of Gardner et al. has a thickness of 6-10 angstroms in column 3, lines 30-32.

Regarding Claim 30, oxide layer 14 of Gardner et al. is being grown at a temperature 700-900 degree Celcius in column 3, lines 35-45.

Regarding Claim 33, annealing layers in nitrous oxide is disclosed in Gardner et al. column 3, lines 40-41 and annealing layers in ammonia is disclosed in Gardner et al. column 4, lines 49-50.

Regarding Claim 35, in claim 1 of DeTar, the ozonated deuterium oxide is in vapor/gas form.

7. Claims 32 and 34 rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner et al. (6,245,652) in view of DeTar (6,077,791) further in view of Foglietti et al. (2002/0142500).

Regarding Claims 32 and 34, Gardner et al. teach a method of making semiconductor device comprising growing an oxide film 14 in Fig. 2, upon a semiconductor topography 10, depositing a silicon nitride film 16, upon and in contact with the oxide film. Gardner et al. fail to disclose the required ozonated substance comprising deuterium oxide. Furthermore, DeTar discloses a method of forming passivation layer using deuterium containing reaction gases where in column 2, lines 61-63, column 3 lines 50-67 and in claim 1, the required ozonated deuterium oxide substance is disclosed. Gardner and DeTar combination fail to disclose the required concentration of the ozonated substance and the required liquid form of the ozonated substance. However, Foglietti et al. teach in step an ozonated deionized water rinse (liquid form) is employed to form an interfacial oxide over the exposed portion of the base region (column 3,



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[0038, first paragraph] and column 4, [0041, first paragraph]) where the ozonated substance has the required concentration in paragraph 13.

It would have been obvious to one of having ordinary skill in the art at the time the invention was made to include the liquid form of ozonated substance and the required concentration of the ozonated substance in Gardner et al and DeTar in order to have a dielectric layer with good interfacial oxidation.

Regarding Claim 32, the required ozonated substance concentration is disclosed in paragraph 13 of Foglietti et al.

Regarding Claim 34, Foglietti uses ozonated deionized water which is in liquid form.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Fazli Erdem whose telephone number is (571) 272-1914. The examiner can normally be reached on M - F 8:00 - 5:00.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sue Purvis can be reached on 571-272-1236. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

FE

February 22, 2007

  
SUE A. PURVIS  
SUPERVISORY PATENT EXAMINER